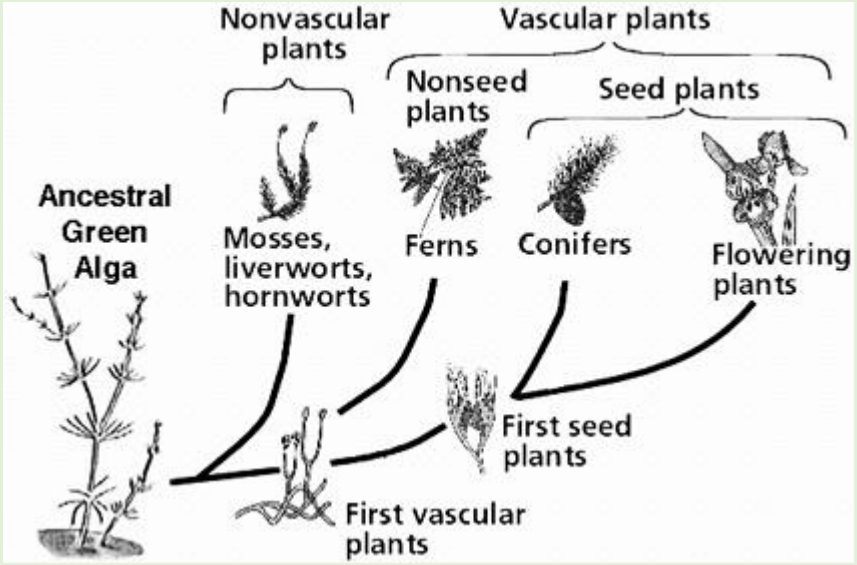
3.8 Kingdom Plantae

- The first land plants are believed to have evolved by around 400 million years ago (about 180 million years before the first dinosaurs ever appeared on Earth).

- It is believed that they likely descended from some sort of **GREEN ALGAE**

Green algae vs PLANTS



Similarities

- Use chlorophyll a and b for photosyn
- Cellulose is found in CWs
- Stores food as starch

DIFFERENCES

Green algae	Plants
• Many are unicellular	• All are multicellular
• Strong dependence on water	• Most are terrestrial
• Lack specialized tissue for life on land	• Have cuticle (waxy coat) and stomata (small openings in epithelial tissue)

Why move to land?

- First of all, it gave them **GREATER ACCESS TO SUNLIGHT**.
- Another advantage was that **CO_2 & O_2 DIFFUSE MORE RAPIDLY** into and out of the plant in air than in water.
- However, there were disadvantages too; for example, one risk of living on land is the risk of **DEHYDRATION**. Plants have many adaptations that prevent them from drying out.

PLANT KINGDOM

1. Non-Vascular Plants

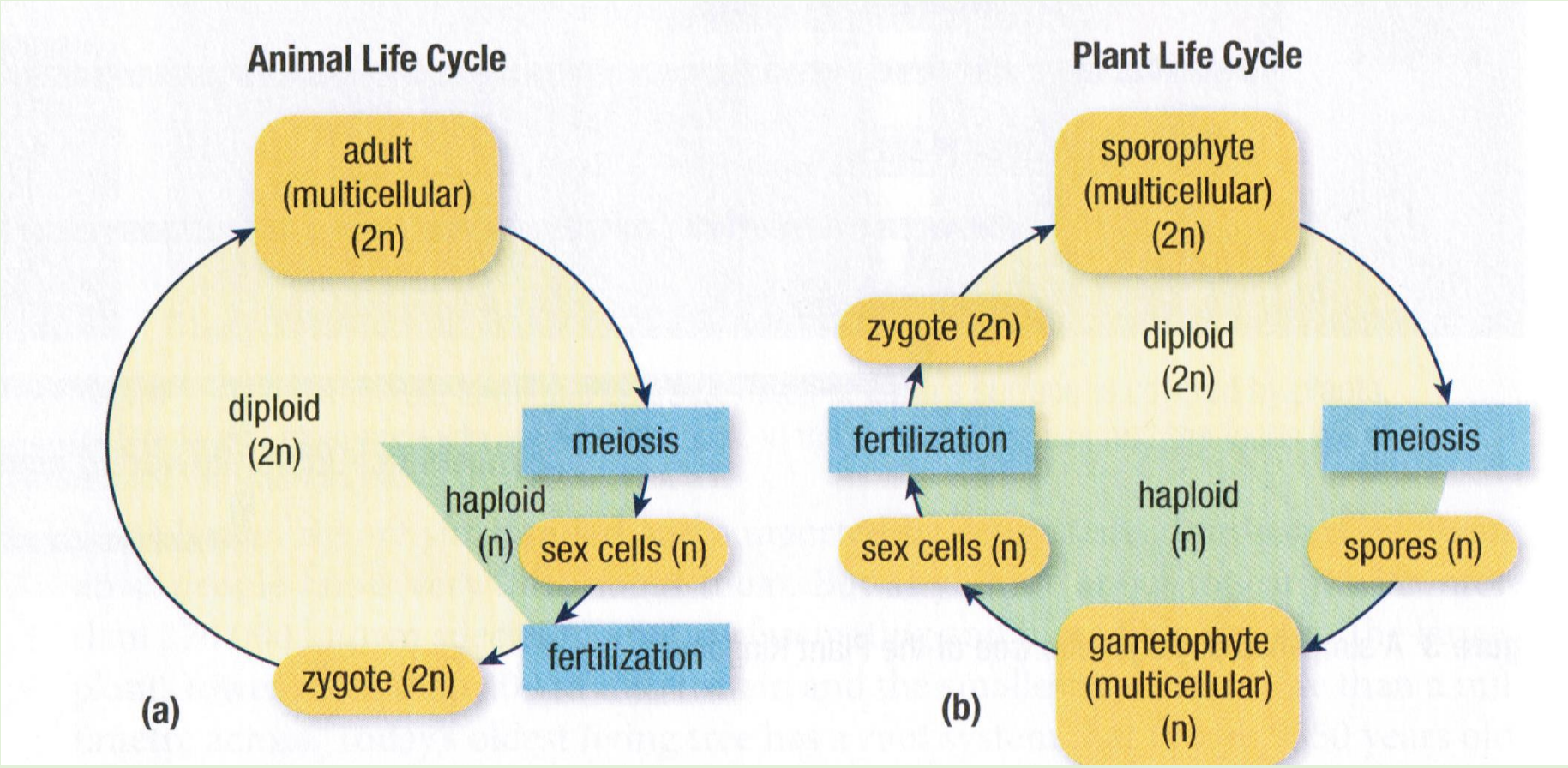
Bryophytes – moss, liverworts, hornworts

- **Lack vascular tissue**, roots, stems and leaves
- Fertilization requires water.
- Fertilization and sporophyte (2n) germination occur within the gametophyte (n)
- Small sporophyte releases haploid spores

Vascular Plants

- Have **vascular tissue** (xylem and phloem to transport water and nutrients in plant)
- Less dependence on ground-level growth
- **Lignin** makes cell walls more rigid (responsible for great strength of woody tissue)

Life Cycle for **all** bryophytes (liverworts hornworts and mosses)



Importance of Vascular Tissue

- In order for roots, stems & leaves to grow, they need a steady supply of water, energy & nutrients.
- Many plants have specialized **VASCULAR TISSUES** made of cells that are able to conduct solutions throughout the plant.
- In many ways, a plant's vascular system is like the CIRCULATORY SYSTEM in animals; CARRYING WATER, DISSOLVED MINERALS & SUGARS to all parts of the plant.
- The evolution of vascular tissue has allowed plants to become much larger than the first plants that colonized the land.

Reproduction in Vascular Plants

- Sexual reproduction is another operation which became slightly trickier for plants as they moved into terrestrial environments

- ALGAE had no problem, simply RELEASED THEIR GAMETES INTO THE WATER and they could SWIM to where they needed to go.

Vascular Plants

2. Seedless Vascular Plants

Lycophytes (club moss) and Pterophytes (ferns) and horsetail (a living fossil)

- Diploid sporophyte (2n) releases spores that grow into small haploid gametophyte (n)
- Gametophyte (n) releases sperm and egg, sporophyte (2n) grows out of gametophyte

Seed Plants

- No longer need water for fertilization
- Male gametophyte (pollen) travels by bug, wind, bird, etc to female gametophyte
- Pollen is hardy, can dry out
- Egg and pollen form a SEED:
  - Contains food source, can remain dormant until favourable growth conditions arise

Seed Plants

- Plants have adapted many PROTECTIVE STRUCTURES to keep their gametes from being dried out, as well as ways that they can TRAVEL ON THE AIR (E.G. SPORES, POLLEN, AND SEEDS CARRIED BY THE WIND or ANIMALS).

- SEEDS are especially interesting structures; they contain the embryonic plant and a small food supply wrapped together in a water-proof coat.

- These reproductive structures can allow EMBRYONIC PLANTS (within the seeds) to SURVIVE WITHOUT WATER, often for many years.

- Seeds were so innovative and advantageous that seed-bearing plants became more widespread and diverse than SEEDLESS PLANTS (which include the FERNS & THEIR RELATIVES).

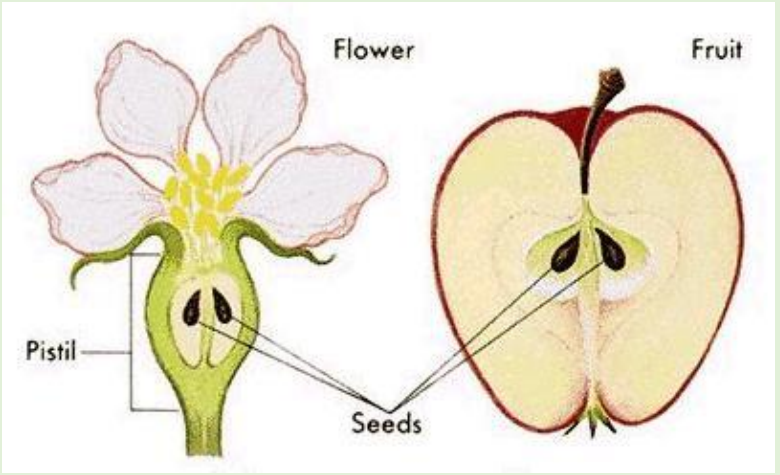
Seed plants

3. Gymnosperms (seeds produced in cones)

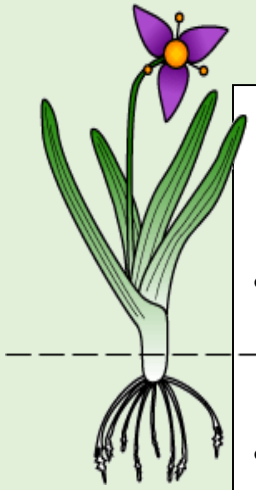
- Pine, spruce, cedar, juniper
- Evolved 280 million year ago – cooler & drier
- Seed “naked” and not enclosed within protective tissue
- Lays exposed on the scale of cone
- Reproduce well without water and survive cold, dry habitats
- Adaptations
  - Thick bark
  - Conical shape
  - Needle-shaped leaves
- Valuable lumber resource
- Maintain biodiversity

4. Angiosperms (produces flowers with enclosed seeds)

- Make-up 90% of all plants
- Fert. occurs in flowers that promote pollen dispersal by attracting bees, birds, and mammals with nectar
- Seed is encased in an ovary that forms a fruit/nut/’wings’ to aid dispersion.



Angiosperms

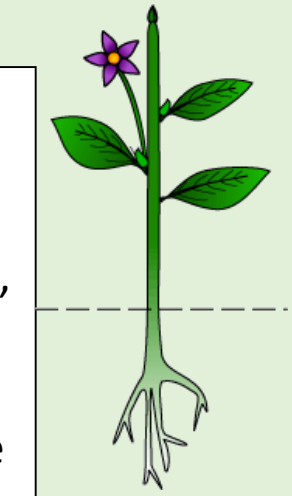


monocots
(60,000 species)

- Grasses, palm, corn and most cereal crops (wheat, oats and barley)
- Has one seed leaf (cotyledon), parallel veins, and adventitious roots

dicots
(200,000 species)

- Most deciduous trees, roses, magnolias, etc.
- Has two seed leaves that store food, veins are net-like and have taproots.



SUMMARY: 2 MAJOR GROUPS OF SEED-BEARING PLANTS	
GYMNOSPERMS	**ANGIOSPERMS**
“naked” + “seed”	“vessel” + “seed”
SIMILARITIES	
Both have stems, leaves and roots	
Both have seeds	
DIFFERENCES	
Have cones	Have fruit
Don’t have flowers	Have flowers
Often have needle-like leaves	Often have broad-shaped leaves